who have not had the advantage of a classical education, might not be surprising, although one would think they would prefer to avoid publicly displaying the fact, and would be willing to travel some distance in order to find some person who could help them in the matter of spelling. But when well educated men support such a doctrine, one feels that they have created out of the law of priority a fetish which they worship with a devotion quite too narrow. The form of our nomenclature being Latin, the rules of Latin orthography and grammar are as incumbent on us to observe, as are the corresponding rules of English grammar in our ordinary speech. This cult, so far as I know, exists only in the United States and among certain members of the American Ornithologists' Union. The preservation of names which their authors never defined; of names which their proposers misspelled; of names from the Greek in Greek instead of Latin form; of English hyphens in Latin composition; and of hybrid combinations of Greek and Latin, are objects hardly worth contending for. Some few authors are quite independent of rules in the use of gender terminations, but I notice the A. O. U. requires these to be printed correctly. Apart from this I notice in the second edition of their check list of North American Birds, just issued, only eighteen misspellings out of a total number of 768 specific and subspecific names, and the generic and other names accompanying. These are of course not due to ignorance on the part of the members of this body, some of whom are distinguished for scholarship, but because of an extreme view of the law of priority.

In closing I wish to utter a plea for euphony and brevity in the construction of names. In some quarters the making of such names is an unknown art. The simple and appropriate names of Linneus and Cuvier can be still duplicated if students would look into the matter. A great number of such names can be devised by the use of significant Greek prefixes attached to substantives which may or may not have been often used. Personal names in Greek have much significance, and they are often short and euphonious. The unappropriated wealth is so great that there is really no necessity for poverty in this direction. It should be rarely necessary, for instance, to construct generic names by adding prefixes and suffixes of no meaning to a standard generic name already in use.

E. D. COPE.

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*THE ORIGIN AND RELATIONS OF THE FLORAS AND FAUNAS OF THE ANTARCTIC AND ADJACENT REGIONS.**

The Geology of the Antarctic Regions. ANGELO HEILPRIN, Philadelphia Academy of Natural Sciences.

Reviewing our present knowledge of the Antarctic regions, Prof. Heilprin stated that it rests almost where it was a half-century ago, when Sir James Clark Ross (1841, 1842) made his memorable cruises in the 'Erebus' and 'Terror,' and attained the high southing of 78° 10′. This was at a position almost due south of New Zealand, along a coast line, sharply defined by elevated mountain masses, to which the daring British navigator gave the name of Victoria Land. At that time other patches of ice bound land, or what was presumed to be land, had already been discovered and named by Bellamy, Biscoe, Dumont d' Urville, and Wilkes—such as Clarie Land, Sabrina Land, etc., south of the Australian continent; Enderby Land, Kemp Land, Graham and Alexander Lands, south of Patagonia—and from these had been constituted the Antarctic continent of Wilkes and of many modern geographers. Murray,

* Report of the discussion before the American Society of Naturalists, Philadelphia, December 27, 1895.

especially, has been strenuous in upholding the actuality of such a continent, but to the present time it cannot be said that its existence has been demonstrated. A number of considerations speak in favor of it, but many more facts than we now possess will be needed before anything like a satisfactory determination of this question can be assumed. It is significant in this connection that both Ross and Petermann, to whom as explorer and student we owe the better part of our knowledge of Antarctica, inclined their views against the existence of such a southern continent. In their opinions the reported land masses are of an island character, bound together perhaps not even permanently, by a vast (frequently shifting?) ice pack, the edge of which (only in small part the terminal wall of giant glaciers) is the 'great Antarctic barrier' of geographers and navigators. How far the vertical icebarrier is confluent with the cemented pack remains yet to be determined.

The only important addition to our knowledge of true Antarctica that has been made since Ross's voyage belongs to the close of the year 1893, when Larsen penetrated, in the region of the Graham Land complex, to Lat. 68° 10′ S., and brought back with him a 'departure' in the geological concept of the region under consideration. The finding of Tertiary fossils (Cytherea, Natica, etc.,) on Seymour Island (Cape Seymour) is the opening vista in an investigation which has heretofore been considered closed, and at once affords, to use a business term, a basis for consideration. Not less significant is the finding at the same locality of an abundance of tree-remains (conifers—Arancaria ?). These fragments at least show that some part of Antarctica was of the same kind of construction as the continents generally, and their special facies immediately suggests a South American relationship. Previous to 1893 the only rocks known from the ice-bound region of the far South were granites, gneisses (and related schists), the strictly eruptive and trappean rocks, and certain red sandstones (Piner's Island—Triassic?) from a very limited area. Most (and perhaps nearly all) of the higher mountains are distinctly of a volcanic nature, and many of them bear huge craters on their summits. Ross found Erebus in eruption at the time of his visit (1841), and Larsen found the mountains of Christensen and Lindenberg Islands similarly active in 1893–94. Borchgrevink, who sailed over a portion of Ross's course in 1894–95, attaining off Victoria Land, with clear water ahead of him, Lat. 74° S., confirms in almost every detail the observations of his predecessor, adding some additional facts regarding the large glaciers which descend from the heights of the Sabine Mountains. He was the first to set foot on the mainland (or main island) of Antarctica, and to him science also owes the first discovery within this realm of a rock-covering vegetation (lichens?—on Possession Island and Cape Adare).

It can hardly be said that we know much regarding either the source or the nature of the vast ice mass which makes up nearly the whole of visible Antarctica; it may or may not be in principal part of glacial construction; it may be largely or mainly an ocean-surface accumulation, extending back in its formation through hundreds or thousands of years. Until we know what is below or behind it, this question will remain unanswered. Giant glaciers there are, and an abundance of them; but over enormous expanses, where the ice barrier presents an impassable front, no visible distant ice cap, like the one of Greenland, has been detected.

In its relations to the other continents there is reason to believe that Antarctica, whether as a continent or in fragmented

parts, had a definite connection with one or more of the land masses lying to the north, and the suspicion can hardly be avoided that such connection was, if with nothing else, with at least New Zealand (and through it, with Australia) and Patagonia. In the fragmented parts of Graham Land archipelago and the outlying South Orkney and South Georgian islands, we seem to have the bond of connection with the South American main; or, more specifically, a line of curvature of the great Andean chain, which, in its broken parts, can still be traced far beyond its present continental termination. If this concept is a true one, it places before us a parallel to the Andean curvature in the northern part of the South American Continent, where the mountain system is deflected off into the broken mass of the Lesser Antilles; to the Aleutian flexure of the Cordilleran system of North America; and to the 'Apennine-Atlas' and 'Carpathian-Balkan' flexures of the Alpine mountains, the nature of which has been so clearly stated by Suess. In fact, it is hardly possible that any very extensive meridianal or latitudinal mountain chain could have been forced up through contractional force without some such deflection being represented in one or more parts of its course; and where these deflections are found they are almost certain to be areas of breakage. The disruption of the Andean system is still (or has until recently been) taking place, as is evidenced in a portion of the Chilian archipelago.

Antarctica Palæontology. PROF. W. B. SCOTT, Princeton University.

It is a truism that the most satisfactory evidence concerning the former existence of land connections which have long since disappeared beneath the sea, is to be derived from the distribution of land animals, recent and fossil. In the northern hemisphere this evidence is very extensive for all of the great land masses, and for those later divisions of geological time in which terrestrial life began to play an important part. In the southern hemisphere the case is unfortunately different, only South America having, as yet, yielded numerous and well preserved remains of Tertiary mammals. Pleistocene fossils, which have an important though somewhat inconclusive bearing upon the problem of the Antarctic continent, occur in other regions, such as Madagascar, Australia and New Zealand, but the evidence is still fragmentary and leaves much to be desired.

In the Permian we first find indications of a type of fossils, common to the southern hemisphere and distinct from the contemporary life of the northern. This is the much discussed *Glossopteris* Flora, characterized by the fern of that name, and by an assemblage of plants which is more like the Triassic than the Permian of the northern continent. The *Glossopteris* Flora has been found in India, South Africa, Australia and, quite lately, in the Argentine Republic, and obviously points to an Antarctic center of distribution. Though the distribution of the *Glossopteris* Flora does not demonstrate that the lands in which it occurs were all connected together, yet it renders such connection probable. Judging from the analogy of the existing land masses, it seems likely that the connection was rather by means of a circumpolar continent with northward extensions than through east and west land-bridges, or a great single continent occupying the site of the Indian, South Atlantic and South Pacific Oceans.

The evidence of Mesozoic fossils is very unsatisfactory. Lydekker has called attention to the likeness between the Jurassic Dinosaurs of India, South Africa and Patagonia, and, so far as it goes, this fact would indicate a general persistence of the same land connections as those which obtained in Permian times.

When we reach the Tertiary, important facts become available, but, as in the earlier ages, too fragmentary to be conclusive. A long succession of Tertiary land faunas is known only from South America. Even the most cursory examination of these faunas shows in the most unmistakable manner the extreme isolation of South America. The oldest of the Tertiary formations of Patagonia, the *Pyrotherium* beds have yielded a fauna which promises to prove of the highest interest, but as yet it is so imperfectly known that it cannot be employed in the solution of the Antarctic problem. The earlier *Miocene* (Santa Cruz) mammals of that continent are totally different from those of the northern land-masses, so much so that the correlation of horizons becomes a matter of extreme difficulty. The hoofed animals all belong to orders unknown in the north, *Toxodontia*, *Typotheria*, *Litopterna*, and the principal constituents of the fauna are immense numbers of *Edentates*, *Marsupials* and *Rodents*, with several platyrrhine monkeys. No artiodactyls, perissodactyls, proboscidians, Condylarthra or Amblypoda, neither Insectivora, Cheiroptera, Carnivora or Creodonta are known. The Edentates are all of the specifically South American type, sloths, armadillos and the like. The Rodents also are very much like those which still characterize the region, though most of the genera are distinct; they are all Hystricomorpha, neither squirrels, marmots, beavers, rats or mice, hares or rabbits occurring among them. The Primates are typically neotropical and evidently belong to the platyrrhine group. The Marsupials are partly opossums, more or less like those which still inhabit the Americas, and, what is at first sight very surprising, partly of Australian type. The latter contain both diprotodont forms (*Abderites*, *Acdestis* *Epanorthus*) allied to the existing *Hypsiprymnus* and polyprotodont genera (*Protoproviverra*, *Cladosictis*, etc.), the affinity of which to the *Dasyuridæ* is clear. Ameghino, it is true, places these latter forms in a new order, the *Sparassodontia*, but this seems unnecessary and misleading.

The fauna of the succeeding 'Patagonian formation' is of exactly the same general character and contains no new elements, but merely somewhat more advanced genera of the same orders, while the Marsupials are much reduced in numbers and importance.

In the Pliocene (Monte Hermoso) appear the first traces of the union with North America, in the presence of mastodons, horses, tapirs, deer, llamas and true carnivores, and from that time till far into the Pleistocene the intermigrations between the two continents kept up, until a large number of common types had been established.

The curious composition of the South American mammalian fauna in Tertiary times presents us with some very well-defined but extremely difficult problems. (1.) How is the presence of groups to be explained, which have a clear relationship to those belonging to the Northern hemisphere, namely the Primates, Ungulates and Rodents? An easy short cut out of the difficulty would be to assume that the relationship is only apparent and due to convergent development. It is, of course, possible that such is the true explanation, but it is most unlikely, and in the absence of any evidence in its favor we need not stop to discuss it. Much more probable is it that these groups point to some connection, direct or indirect, with the northern hemisphere, either in late Mesozoic or early Tertiary times. One would naturally expect to find that this connection was by way of North America, but there are grave difficulties in the way of such a view. As we have seen, the indigenous South American rodents were all hystricomorphs, and while this group is represented in Europe,

in later Oligocene beds, it does not appear in North America till the end of the Miocene or beginning of the Pliocene, and is very scantily represented here to-day. The Ungulates are much more distantly related to those of the north and can be connected only by remote ancestors, for the divergence is very striking in the oldest South American forms yet recovered. If the connection with the north was not by means of North America it can only have been through Africa. Admitting such connection, it is much more likely to have been due to the junction of both continents with the Antarctic land mass than to a Transatlantic bridge. Such a mode of connection would explain the very wide divergences in the character of the mammalian faunas which still exist between Africa and South America, for a circumpolar land would very likely oppose climatic barriers to migration, and confine that migration to comparatively few groups. (2) The presence of numerous marsupials of distinctively Australian type in the Tertiary rocks of South America is very strong evidence indeed that both of those continents were connected with the Antarctic land. The Australian marsupials have been much misunderstood and many observers appear to think that Australia is a sort of museum which has preserved Jurassic types to this day. As a matter of fact, these marsupials are an extremely diversified and modernized assemblage of forms, which have paralleled the placental orders in a remarkable way. Their structure is, it is true, fundamentally primitive, but their many and divergent adaptions are modern. That these marsupials indicate a land connection between South America and Australia can hardly be denied, for none of them have ever been found in any northern continent. If it be asked why this supposed migration was all in one direction, and why South American mammals did not reach Australia, several possible explanations suggest themselves. (a) The marsupials may have originated in South America and, covering the South Polar lands, have reached Australia, which was then severed from Antarctica, before the Placentals had made their appearance in South America. (b) Placentals may have reached Australia but not kept a foothold there, finding conditions unfavorable to them. These possibilities seem very unlikely and much more probable is a third explanation. (c) The Australian connection with Antarctica first existed and allowed the marsupials to spread over the polar lands. Before South America became connected with the circumpolar area, the latter was severed from Australia. Until Tertiary mammals are recovered in Australia, explanation of these curious circumstances must remain conjectural. What is known of Australian Pleistocene mammals indicates that nothing had reached that continent from South America.

Another line of evidence which trends in the same general direction as that which we have already considered is given by the Pleistocene birds of the southern hemisphere to which attention has been directed by Forbes, and more recently by Milne Edwards and others. The weight which should be given to evidence of this kind is very difficult to determine, because of the uncertainty which still obtains concerning the real relationship of the birds in question. The extinct types of wingless rails which are found in New Zealand, the Chatham Islands, the Mascarene Islands are believed by many to indicate land bridges, while Æpyornis, of Madagascar, the Moas of New Zealand, the Emeus of Australia, and the gigantic Tertiary birds of the Argentine Republic (Brontornis, Phororhacus, Opisthodactylus), are supposed to be branches of the same stock of Ratitæ. Until, however, we learn a great deal more than is known at present with regard to

the phylogeny and relationships of these great birds, I personally do not feel at all assured that we can safely reason from their distribution to problems of former land connections. On the other hand, it should be noted that this distribution is in harmony with the results reached by study of the mammals.

In conclusion, it may be observed that the facts of paleontology may best be explained on the assumption that the Antarctic land mass has at one time or another been connected with Africa, Australia and South America, which formerly radiated from the South Pole as North America and Eurasia now do from the North Pole. While this seems a highly probable assumption, much remains to be done before the history of the southern continents is as well known as that of the northern ones, and in particular many questions must remain open until the Tertiary mammals of Africa and Australia shall have been recovered. It is interesting to observe that we are again approximating to the views expressed by Rütimeyer in 1867.

Botany. Prof. N. L. Britton, Columbia College.

Prof. Britton took up the subject from the standpoint of Antarctic botany. He remarked that as nothing worth consideration was known of the flora of the Antarctic Continent, the inquiry must be restricted to a consideration of the vegetation of the extreme southern parts of South America, South Africa, New Zealand and the islands of the South Pacific Ocean. Genera of wide distribution cannot enter as factors in the inquiry, except in cases where closely related or identical species occur in two or more of these areas. Genera and species of circumtropical distribution must be considered with caution, because this distribution may or may not have a bearing on the problem. He noted that this circumtropical distribution of plants is well marked, large numbers of genera and species being common to the warmer parts of America, Australasia and Asia, and some common to tropical America and Africa. Types of cosmopolitan distribution must obviously be ignored. Types of simple organization, typically of wide distribution, cannot fairly be considered.

He submitted the following cases of distribution, selected from widely different families from the Bryophytes upward:

Musci. *Andræa pseudosubulata.* Fuegia and Australia. *Campylopus xanthophyllus.* Chile and New Zealand. The genus *Codonoblepharum* contains about eleven species, six in southern South America, three in New Zealand, two Asiatic. The genus *Hymenodon*, of six species, has two in southern South America, three in Australasia, one in tropical America. *Leptotheca Gaudichaudii* occurs in New Zealand, at the Falkland Islands, and Cape Horn. The genus *Leptostemon* consists of about eight species, two of them in southern South America, five in Australasia, one in Ceylon.

Filices. *Grammitis australis* and *Lomaria alpina* occur in southern South America, Tasmania, New Zealand, and the latter on Kerguelan. The genus *Gleichenia*, mostly confined to the tropics, contains related species in South Africa, southern South America and New Zealand.

Coniferæ. The genus *Araucaria* contains ten species, all South American and Australasian. *Fitzroya Patagonica* occurs in Chile and *F. Archeri* in Tasmania. The genus *Podocarpus* has about forty species, South American, South African, Australasian and Asiatic.

Aponogetonaceæ. *Aponogeton* contains about fifteen species, African, Australian and Asiatic.

Alismaceæ. *Caldisia* with three species in Africa, New Holland and the East Indies.

Centrolepidaceæ. *Gaimardia australis* in

southern South America, *G. setacea* in New Zealand.

JUNCACEÆ. *Marsippospermum grandiflorum* in the Magellan region, *M. gracile* in New Zealand.

LILIACEÆ. The genus *Wurmbea* has two species in South Africa, one in Fernando Po, four in Western Australia. *Bulbinella* has ten species in South Africa, one in New Zealand, one in the Auckland Islands. *Bulbine* has twenty-one species in South Africa, two in Australia. *Cœsia* has six Australian species, three South African. *Luzuriaga* contains three species, all of southern South America, but one of them, *L. marginata*, occurs also in New Zealand.

AMARYLLIDACEÆ. The tribe Conantheræ contains four genera, three of them Chilian, the fourth at the Cape of Good Hope.

IRIDACEÆ. The genus *Libertia* has four species in Chili and four in New Zealand and South Australia.

FAGACEÆ. *Nothofagus* contains twelve species, and is confined to southern South America, New Zealand and Australia.

URTICACEÆ. *Australina*, with five species, natives of Australia and South Africa.

PROTEACEÆ. All the genera are austral. According to Engler the species are distributed about as follows: Australia 591, South Africa 262, tropical South America 36, New Caledonia 27, tropical East Africa 25, Chile 7, tropical Africa 5, New Zealand 2, Madagascar 2.

POLYGONACEÆ. The genus *Muehlenbeckia* is confined to Australia, New Zealand, the Pacific Islands and southern South America and the Andes.

MONIMIACEÆ. *Laurelia sempervirens* in Chile, *L. Novæ-Zealandiæ* in New Zealand.

UMBELLIFERÆ. The genus *Azorella* with 30 species distributed in Australia, New Zealand, southern South America and the Andes.

EPACRIDACEÆ. The whole family is Australasian, save one species occurring at Fuegia.

STYLIDEÆ. The genus *Phyllachne* has one species in the Magellan region, three in New Zealand.

In closing, Professor Britton remarked that despite the occurrences cited, and that he had not been able to treat the subject exhaustively, the similarity of the floras was in reality very slight, and that in his opinion it was not necessary to invoke former land connection across the Antarctic region in explanation.

The Terrestrial Invertebrata. By PROF. A. S. PACKARD, Brown University.

In comparing the terrestrial Arctic and Antarctic regions the conditions are most unlike, and literally as wide apart as the Poles. The Arctic regions form a large proportion of the land hemisphere, with a comparatively abundant terrestrial flora and fauna. During the Neocene Tertiary, the arctic land masses were more extensive than now, more continuous, and with little doubt their subtropical life-forms, both plant and animal, constituted an assemblage which sent out waves of migration passing southward and colonizing either side of the American and Eurasian, late Tertiary, continents. The present Arctic and Alpine life, as also the plants and animals of boreal and north temperate Eurasia and America are with little doubt the modified descendants of the Tertiary Arctic regions.

When we pass to the South Pole the conditions are, in the light of our present knowledge, diametrically opposite. The continental Antarctic land masses may or may not be connected. Until 1893 a human being had not landed on the mainland, and even then the ice and snow-clad land revealed only a few lichens, and the rocks a few specimens of Tertiary strata. Not a trace of terrestrial invertebrate life was discovered.

Should, as it is to be earnestly hoped, an Antarctic expedition at no distant day ex-

plore the mainland, it may be predicted, judging by what we know of the invertebrate land fauna of Kerguelen Island, that one or two Lumbricoid worms, a terrestrial mollusc, one or two species of spiders, several species of acarina, and of Collembola, a few species of Coleoptera, Lepidoptera and Diptera (including perhaps a mosquito), and possibly some species of parasitic Hymenoptera, will be found to constitute the land invertebrate fauna.

Should any flowering plants ever be discovered, there will probably be added to the list a few of the higher moths, and possibly a butterfly, a bumble bee or two, and a few muscids, which in the high Arctic regions visit flowers. As there are no land birds or indigenous mammals, nor so far as we know any summer migrant birds, such insects if present should abound in individuals, there being no larger animals to reduce their numbers.

We may now proceed to enumerate the terrestrial fauna of Kerguelen Island, the nearest region of whose land invertebrates we know anything.

VERMES. Family Lumbriculidae.

Acanthodrilus Kerguelensis Lankester. (Inhabiting fresh water streams or pools?)

MOLLUSCA.

Helix hookeri Pfr.

ARACHNIDA.

Myro Kerguelensis Cambridge. Tents numerous under large stones.

Acarus, two species, a red mite on the leaf stalks of the Kerguelen cabbage; and a yellow species abounding on the sides of rocks frequented by cormorants. (Also bird-mites, mallophaga, on marine birds.)

INSECTA. *Collembola.*

Tullbergia antarctica Lubbock, in moss.

Isotoma sp.

Smynthurus sp. under stones.

COLEOPTERA.

Rhyncophora or weevils' six species, also a Staphylinid (*Phytosus atriceps*). These occurred in moss or under stones. Kidder states that "most of the species were incapable of flight, their wing-cases being soldered together." Some of the largest forms were good fliers, however, "the largest and most brilliantly colored specimen taken having flown into my hut one night, attracted by the light." Besides these "little black beetles were caught on rocks near the sea and about the roots of wet tufts of moss." They belong to the genus Octhebius, of the aquatic family Helophoridæ.

LEPIDOPTERA.

Dr. Kidder captured "two lepidopterous insects of moderate size, with very imperfect and abbreviated wings, active in their movements." Mr. Eaton found quite a number of larvæ and pupæ of a small nocturnal moth, remarkable for the extreme brevity of the second pair of wings. He names it *Embryonopsis halticella.*

DIPTERA.

Besides *Musca canicularis* Linn., a cosmopolitan species, six species of flies belonging to new genera, four of which have vestigial wings, are characteristic of this island, and are of peculiar interest.

Dr. Kidder remarks of three of the genera of wingless flies that they counterfeited death when in danger. The carrion feeder (*Anatalanta aptera* Eaton) has no vestige of either wings or balances (halteres).

The leaf feeders (*Calycopteryx mosleyi* Eaton), found on the leaves of the Kerguelen cabbage, resembled large black ants, as they were active in their movements, dark brown, with long legs. The wings are reduced to small scales.

"The third genus (*Amalopteryx maritima* Eaton) was discovered on wet rocks at the

edge of the sea. They are provided with small triangular vestigial wings and balancers." They cannot fly, but seem to use the wings in jumping, which they do with great activity, making it quite difficult to catch them. They do not appear to jump in any definite direction, but spring into the air, buzzing the small winglets with great activity, and seem to trust to chance for a spot on which to alight, tumbling over and over in the air. I never observed them jumping when undisturbed.

Dr. Kidder adds that 'the only flying insect observed by me while on the island' (he apparently momentarily overlooked the larger flying weevil) was a small gnat. Mr. Eaton also describes a tipulid (*Halyritus amphibius*) with imperfect or abortive wings.

Of the exact relationship and origin of this restricted island fauna, but little in the present state of our knowledge can be said. To which family the moth belongs I am at present unable to state. As to the Diptera they are mostly muscidæ, and this family is more largely represented in the Arctic regions and on Alpine summits the world over than any other group. But this is not the case with the Coleoptera; of this order the Carabidæ are most numerously represented in Arctic and Alpine regions, and they are common in Chili, while the weevils are the least in number of species in Arctic regions. And yet out of the eight species of beetles inhabiting Kerguelen Island, six are weevils, a group most numerously represented in subtropical and tropical regions. This would seem to indicate that this island was colonized by waifs from the land to the westward, whether from Australia, Africa or South America, I should not dare to say. On the other hand, the land plants and the marine fauna appear to have elements more in common with Patagonia and Fuegia, and this may be explained by the cold polar current which is said to flow from the Antarctic region towards Cape Horn.

Darwin has, in his Origin of Species, called attention to a remarkable feature of the Madeiran Coleoptera, *i. e.*, the unusual prevalence of apterous or wingless species. No less than twenty-two genera which are usually or sometimes winged in Europe having only wingless species in Madeira. Mr. Wallaston discovered that 200 beetles out of 550 species then known to inhabit Madeira are so far deficient in wings that they cannot fly. These facts led Darwin to believe "that the wingless condition of so many Madeira beetles is mainly due to the action of natural selection, but combined probably with disuse. For during many successive generations each individual beetle which flew least, either from its wings having been ever so little less perfectly developed or from indolent habits, will have had the best chance of surviving from not being blown out to sea; and, on the other hand, those beetles which most readily took to flight could oftenest have been blown to sea and thus have been destroyed." On the other hand, the wings of the flower-feeding Coleoptera and Lepidoptera, which are habitually on the wing, 'have, as Mr. Wallaston suspects, their wings not at all reduced, but even enlarged.' He adds that the proportion of wingless beetles is larger on the exposed island Desertas than in Madeira itself. Mr. Wallace, in his great work, 'The Geographical Distribution of Animals' (ii., pp. 211), cites the wingless insects of Kerguelen Island as a remarkable confirmation of this theory.

The poverty of the land fauna of Kerguelen Island, and the reduction in the wings of the insects, are so intimately correlated with the extremely unfavorable climatic condition under which these animals exist that the loss or reduction in the size of the wings may, we venture to suggest, be explained as the result of the direct action of some of the primary factors of organic evolution.

As Dr. Kidder states: "The general aspect of the island is desolate in the extreme. Snow covers all the higher hills. Only along the seashore is a narrow belt of herbage, of which the singular Kerguelen cabbage is at once the largest and most conspicuous component. The weather is also extremely inclement, there being scarcely a day without snow or rain. Violent gales of wind prevail to an extent unknown in the same northern latitude. It was often impossible to go on foot any considerable distance from the home station on account of the severity of the wind. Sir J. Clarke Ross tells of one of his men being actually blown into the sea, and of saving himself from a like accident only by lying flat on the ground." There are no shrubs or trees on the island. The winter season is remarkably mild.

This set of climatic conditions, the continued strong winds, the low temperature throughout the year, and the absence of the sun for the greater part of the year constitute an environment sufficient, we should think, to account for the disuse and resulting atrophy of the wings without invoking the aid of natural selection, unless we allow that the principle may work as a final and subordinate factor. At all events, these agencies and disuse should be the first to suggest themselves, as they are so tangible and easily understood.

Under these conditions the beetles, flies and moths would be driven to seek shelter under stones or by burrowing deep in the damp wet moss. By simple disuse, the wings would begin to atrophy, and after a comparatively few generations become reduced, or in extreme cases almost entirely lost. Certainly the initial cause is the climatic conditions. To these persisting century after century the organism would directly respond, and we do not see the need of evoking the aid of natural selection, ingenious and speculative as it is, any more than in accounting for the loss of eyesight or of eyes, with important parts of the brain, in cave animals, or in deep sea or abyssal forms, we should resort to natural selection. Moreover Darwin himself expressly stated that in the case of cave animals natural selection was not operative. Certainly in the present case disuse due to the direct action of the environment appears to be an efficient, adequate cause.

Vertebrata of the Land; Fishes, Batrachia and Reptiles. By Dr. Theo. Gill, Washington.

Dr. Gill called attention to the discrepancy between the evidence already deduced from the plants and invertebrates and that which would result from the consideration of the higher vertebrates. These discrepancies are in accord with the differences in the geological history of the several classes. For example, all the families of mammals, so far as certainly known, have originated since the commencement of the tertiary; most of the prominent families and very many genera of mollusks still existing, flourished at least as early as the Jurassic and Cretaceous. (The Jurassic fresh-water faunas were especially considered.) Fishes are intermediate between those two types. Naturally, the persistence in duration of the several classes is reflected in the distribution in space. Many families of mammals are confined to special zoögeographical continents, but extremely few families of articulates or mollusks are so limited. In fact, we can avail ourselves of the data furnished by the different divisions for chronometrical purposes; the mollusk answers to an hour hand, the mammal to a minute hand. The fishes yield data for the determination of intermediate points. Remembering these postulates, the evidence given by the distribution of the fresh-water fishes is significant; less so is that of the amphibians and reptiles because they have superior means of locomotion.

There are two families of fresh-water fishes confined to the cold and temperate waters of the southern hemisphere and generally distributed in such; they are the Galaxiids and Aplochitonids; the former were associated by the old ichthyologist with the pikes, and the latter with the salmonids, but they really have no such relationship, but are closely related to each other and segregated from all others. The Galaxiids are represented by one genus, *Galaxias*, of which about five species occur in South America, five species in Tasmania, ten species in Australia and five species in New Zealand. (A monotypic genus, *Neochanna*, is confined to New Zealand.) The Aplochitonids number only six species, referable to two genera; of these two are found in South America (*Aplochiton*,) two in Tasmania (*Aplochiton* and *Prototroctes*), one in Australia and one in New Zealand (*Prototroctes*).

It was long supposed that no species of either family of Galaxioidean fishes occured in Africa, but last year Dr. Steindachner described a representative of *Galaxias* (*G. capensis*) and consequently we now have South Africa to consider with reference to a former community of population and continuity of land of all the southern hemisphere.

The conditions of existence and propagation of fresh-water fishes were then discussed and the chances against diffusion of any fresh-water fish across the ocean or by other means than natural water courses were weighed.

In finally taking into consideration the limited distribution northwards and the close relationship of the species of the several regions referred to, it was urged that the evidence in favor of a former Antarctic continental area was strong, and, in view of the affinities of the species of the now distant regions, the conclusion was logical that the time of disruption was not remote in a geological sense. It was suggested that such disruption might have been coëval with the final uplift of the Andes.

The amphibians and reptiles furnish no data bearing directly on an Antarctic continent, but do yield some (though very slight) bearing on an earlier and more northern connection of the southern continents. Much more cogent and less ambiguous is the evidence resulting from the study of the fishes.

The fishes of tropical Africa may be ranked under two grand categories. One of these comprises species of genera or groups represented more largely in Asia, and the other of forms related to types otherwise confined to tropical America. These Afric-American forms belong to the extensive families of Characinids and Cichlids or Chromids. Fishes of these families are the most conspicuous and numerous in both continents. The representatives of the two families of the different continents always belong to different genera, and often to different groups of genera or subfamilies. We have, therefore, in the fishes, as in the mammals, conflicting evidence. According to one set of facts, the continents of Africa and Asia are similar, and, in fact, they have been united to form one zoölogical realm; according to the other the primitive fauna of Africa is more like that of America. Just two decades ago (1875) the speaker explained this apparent contradiction by the assumption that the aboriginal types had been early derived from a common source, and, for that reason, combined Africa with South America and Australia in a zoölogical hemisphere which he named EOGÆA, and contrasted with another called CÆNOGÆA, embracing Asia, Europe and North America. The numerous species congeneric with Asiatic and European types, were considered to be recent emigrants, geologically considered. The purport of all the evidence was that there may

have been some connection between Africa and South America early in the tertiary epoch. This connection in the present condition of our ignorance of paleontological facts, appears to be more probable than the derivation of the common peculiarities of the faunas of the two continents from a former cosmopolitan fauna or northern areas which have lost them, leaving them to the two southern continents only. The union of Africa with Asia culminated too late to allow of much differentiation of the invading forces that spead over its wide domain.

A former quasi-cosmopolitan fauna was nevertheless manifest in the case of the Ceratodontids, but in Europe and North America they flourished early in Mesozoic times, and none survived later than the Jurassic, and approximately coëval with them were species which lived in India and Africa, but all these died out and the only survivors are the species of *Neoceratodus* of tropical Australia. This family was mentioned as an extreme case of persistence for an osseous fish type.

The amphibians furnish very ambiguous evidence if the accepted taxomy is correct. For example, on the one hand the Cystignathids are well developed and limited to America and Australia, but on the other the Discoglossids are all European, except one genus (*Liopelma*), and that is confined to New Zealand.

The reptiles contribute data looking in different directions. One of the ablest herpetologists of all time has expressed the opinion that 'if a division of the world had to be framed according to the lizard faunas,' the Ethiopian and Palæarctic regions should be combined in one (*Occidental*) and the Australian and oriental in another (*Oriental*), to be themselves aggregated in a realm (Palæogean) differentiated from another (Neogean), comprising the Neotropical and Nearctic regions. Their mode of distribution in fact approximates that of birds, but has been seriously affected by their intolerance of cold and consequently the loss of types, which might be interchanged between the continents. The similarity between the African and Palæarctic regions is doubtless due to the intrusion of forms from the latter into the former. The African, however, has three small families restricted to its area and two shared with America. Quite different is the distribution of the tortoises.

The superfamily of the Pleurodirous or Chelyoidean tortoises is restricted to the southern continents. One family (Sternothærids) is peculiar to Africa, one (Chelyidsé to America and one (Chelodinids) to the Australian realm, while one (Podocnemidids) is common to Africa and America, and another (Rhinemydids) to America and Australia. Except in America these completely replace the fresh water cryptodirous tortoises, but it is noteworthy that species of the terrestrial Testudinids, generally considered as congeneric, occur in all the warm continents except the Australian. It must not be forgotten that formerly (in early tertiary times) the Chelyoideans were represented and, it has been claimed, even by a still existing genus (*Podocnemis*) in the northern hemisphere, and therefore their present occurrence only in the southern continents loses much of its significance. The evidence of former connections of the southern hemisphere furnished by both amphibians and reptiles is indeed of very little account *per se* and is only significant as collateral to that presented by other classes.

To sum up the results of studies of the several classes, the present evidence points to a comparatively recent union of or connection between the southern continents. The inference (independent of the ichthyological data) is based in part on the information respecting the geological duration of

mammal families derived from studies of northern strata and in part on the identification of mammal remains of Patagonian strata with Dasyurids, but this evidence may prove illusive. Of some importance in estimating the age is the rediscovery by Mr. Thomas after 20 years of the *Hyracodon* of Tomes and its reference to the supposed extinct family of Epanorthids. This evidence, however, is by no means conclusive. Rather violent assumptions become necessary of remarkable dynamical conditions and the peopling of the said continents by the same type may be hereafter explained otherwise. But in the present condition of our knowledge (or ignorance, if you will), less violent assumptions appear to be called for by the hypothesis that has now been presented than by any other. It must be distinctly understood, however, that it is a hypothesis and a *tentative* hypothesis only. But until it is replaced by a better one or by ascertained facts, the hypothesis will assuredly be useful in directing investigation.

Vertebrata of the Land; Birds and Mammals. By DR. J. A. ALLEN, American Museum of Natural History, New York.

So far as existing mammals and birds are concerned, there seems to be very slight need for calling in the aid of a former Antarctic continent to explain their present distribution. Among mammals the distribution of Marsupials alone gives a hint of a possible former land connection between South America and Australia. The recent discovery (Thomas, Ann. and Mag. Nat. Hist. (6) XVI., Nov. 1895, p. 367) of a form of Marsupial in Colombia belonging to the hitherto supposed extinct family Epanorthidæ, and the occurrence of several distinctly Australian types among the fossil Marsupials of Patagonia, would seem to add much emphasis to this hint. On the other hand, the absence of all other South American types of either mammals or birds from the Australian region, and the presence of the remains of numerous opossum-like animals in the Eocene of both North America and Europe, suggest a possible line of extension by way of the northern land masses without the aid of any former land bridges in the southern hemisphere. Possibly worthy of consideration here is the wide distribution of Mesozoic mammals and the probable Marsupial affinities of at least some of them.

In regard to birds, after excluding wide-ranging types, which have no bearing on the subject in question, there are no groups common to South America and either Africa or Australia. The distribution of the so-called Ratitæ and other flightless birds so often cited as evidence of a former Antarctic continent, has really very little bearing on the question. The so-called sub-class Ratitæ includes, according to the best recent authorities, no less than six orders, of which the South American rheas (Rheæ) form one, and the only one found in the New World; the ostriches of Africa form another (Struthiones), which in Pliocene times ranged as far north and east as southern Europe and India; the kiwis of New Zealand form a third (Apteryges); the cassowaries and emus of the Australian region a fourth (Megistanes); the recently extinct genus *Æpyornis* of Madagascar a fifth (Aepyornithes), and the recently extinct moas of New Zealand a sixth (Immanes). The prevalent notion that all these forms are closely related and must have had a common origin doubtless rests on such superficial resemblances as large size and flightless condition.

Mainly for the same insufficient reason it is the fashion to refer to the Ratitæ such little known extinct forms as *Gastornis* and *Dasornis* of Europe, *Diatryma* of North America, and *Brontornis*, *Phororhacos*, *Pelycornis*, *Opisthodactylus*, etc., of Patagonia. Although

some of them appear to have Ratite affinities, others present quite as strong relationship to Carinate types. Most of them are known, however, from such fragmentary remains that little can be said as to their real affinities. Indeed, it is the belief of several eminent authorities that the so-called Ratitæ constitute a very heterogeneous group, the prominent types of which originated independently from perfectly distinct Carinate ancestors. The fact of the occurrence, either still living or only recently extinct, of degenerate flightless forms in such widely distinct Carinate groups as parrots, birds of prey, pigeons, ducks and geese, coots, gallinules and rails, auks, grebes, etc., and that they are in general among the largest members of their respective groups, and also generally inhabitants of islands, shows that mere flightlessness, large size, insular habitat, and an unkeeled sternum are factors of slight importance.

Mr. H. O Forbes in his plea for an Antarctic continent (Antipodea) originally laid great stress upon his discovery at the Chatham Islands of an extinct flightless rail allied to an extinct flightless rail of the genus *Aphanapteryx* found in Madagascar. Indeed, this discovery seems to have been largely the foundation of his original 'tremendous hypothesis,' as Mr. Wallace has called it, of an Antarctic continent. In Madagascar *Aphanapteryx* was contemporary with the dodo, both existing down to about two hundred years ago. The Chatham Island remains were found in kitchen middens of the Morioris, showing that here the supposed *Aphanapteryx* existed to a comparatively recent date. Later examinations by competent authority, however, of the Chatham Island remains has shown that they are not congeneric with *Aphanapteryx*.

It is of interest to note in this connection that some ten genera of flightless Ralline birds are known, three or four of which are still living, while most of the others have become extinct only within historic times. They are all island birds, and nearly all happen to occur in the southern hemisphere, the localities being the islands of Mauritius, Rodriguez, Gough, Tristan d' Acunha, Samoa, Chatham, and New Zealand, but ranging north also to the Moluccas. Furthermore, it happens that they represent all of the leading types of the family Rallidæ, as rails, coots, gallinules and porphyrios, and hence have no very intimate relationship. The fact of their being insular forms thus has not necessarily any bearing on the question of former southern land areas, especially since they are as much tropical and subtropical as austral, and belong to an ancient type of bird life of cosmopolitan distribution. The current belief among ornithologists is that all these forms originated at or near where they are now found from ancestors that could fly. In support of this belief is the fact that one of the earliest marks which distinguish insular forms from their nearest mainland allies and probable ancestors is the reduction of the wings and the corresponding increased development of the pelvic limbs, as is illustrated in the birds of the Guadalupe Islands off the coast of Lower California, and the Galapagos Islands. This change is obviously the result of the new conditions of life—the very limited area to which they are restricted, their sedentary and non-migratory habits, and their comparative freedom from harrassing rapacious enemies.

The Ratitæ and supposed Ratite forms which have so generally been cited in evidence of former connected Antarctic land areas, in reality afford no greater proof of such land bridges than do Carinate birds, when we consider how very distinct are the ordinal groups into which this subclass is divided, and how widely each one is separated geographically from all the others. If we had moas, or ostriches, or kiwis, or cassowaries, or any one of the six orders

represented in all three of the present southern continents, or in even two of them, the case would be different. The single order Passeres includes families peculiar respectively to South America, Africa and Australia, which are far more closely related to each other than are the several orders of the Ratitæ *inter se;* yet no one thinks of urging these Passerine groups as evidence of a former Antarctic continent. They are supposed to have originated independently where they are now found and to have never existed elsewhere.

There are, on the other hand, several families of Carinate birds, belonging to different orders, which inhabit the tropical and subtropical regions of both the Eastern and Western hemispheres, but which now and for long ages past have had no possible means of migration from America to Africa, or to India, or to Australia. That the present New World and Old World representatives of these several groups must have had, respectively, a common origin is beyond question; and it is believed to be equally beyond question that they reached their present areas of distribution by the northern land route that formed the means of intercommunication between the northern land masses for so many of the widely dispersed terrestrial forms of life.

Another factor bearing on the general question is the early origin of many of the existing genera of birds, most of the known Pliocene genera still surviving, while many of the Lower Miocene and Upper Eocene genera of Europe and North America are in some cases identical, in others closely allied, to genera still living. Some of them are now restricted to the tropics, but their ranges formerly extended far to the northward of their present limits.

In short, birds afford no clear evidence in favor of the existence of a former Antarctic continent, and mammals only that afforded by the distribution of the Marsupials.

Vertebrata of the Sea. By THEO. GILL, Washington.

On account of the enforced absence of Dr. Goode, detained in Washington by official business, and at his request, Dr. Gill considered the subject assigned to him—the fishes of the sea in relation to the Antarctic continent.

There is really no direct evidence furnished by sea fishes bearing on the question at issue. There are, however, some facts which may throw light on a certain phase of the question. The fishes of the Antarctic seas are very imperfectly known, but the few that are known are of much interest and belong to two very distinct categories.

On one hand, we have a few species belonging to a couple of families only occurring in the extremely cold waters—the Chænichthyids and Harpagiferids. The genera of these families have been referred to the family of Trachinids, but really manifest no affinity to the typical forms of that group. The only inference that appears to be derivable from the two families is that the supposititious Antarctic continent may have been in all Tertiary geological times at least deeply indented by extensions of the ocean far towards the Pole.

On the other hand, in the Antarctic seas recur representatives of genera which have been only found in high northern waters, such as *Myxine*, *Squalus*, and *Merlucius*, and those representatives are so closely related as to have been united in two cases as conspecific. It appears to be most reasonable to postulate for such types derivation from a common source, and that their extension may have been effected in the cold waters of the ocean depths. It is more than possible that, under favorable conditions, species of *Myxine*, *Squalus* and *Merlucius* may yet be found in the cold deep waters below even equatorial seas, for it is to be remembered that all have an extensive bathymetrical range.

Another fact of interest and significance is that there are very few types of Gadids in the Antarctic or cold temperate seas. Their place is taken by representatives of a family of acanthopterygian fishes apparently related to the Chænichthyids and Harpagiferids already mentioned; the Nototheniids, as they are called, are of many closely related species, and in their mode of occurrence and habits appear to be analagous to the codfishes of the north. Their distribution, however, does not throw the least light on the question of an Antarctic continent.

SCIENTIFIC NOTES AND NEWS.

ASTRONOMY.

THE *Astronomisches Jahrbuch* for 1898 has just been issued. It is volume No. 123 of the series, and its preparation has been supervised by Dr. P. Lehman, who was placed in temporary charge of the Berlin computing bureau after the death of Prof. Tietjen.

THE *Astronomical Journal* of February 17th contains a determination of the elements of the orbit of the binary star F. 99 Herculis, by Dr. T. J. J. See. The orbit obtained is very remarkable because of the fact that the inclination comes out exactly zero. It follows that we see the orbit just as it is, instead of its being projected on the sky with more or less foreshortening. Some uncertainty attaches to this interesting orbit, however, because a former orbit by Mr. Gore and one by Dr. See himself agree in making the inclination more than thirty degrees. H. J.

Nature states that at the last meeting of the Royal Astronomical Society, the Astronomer Royal gave some particulars relating to the progress at Greenwich of the international photographic star catalogue. A special staff for dealing with this work has been organized under Mr. Hollis, and already 130 of the plates taken for the catalogue have been measured. It is estimated that 180 plates can be measured, and 160 of them reduced in the course of a year, so that at this rate the section allotted to Greenwich, comprising about 150,000 stars, will be completed in five or six years. Assuming that the other sixteen coöperating observatories are proceeding equally well, the world will soon be in possession of a colossal catalogue, comprising between two and three million stars.

EXTINCTION OF THE BUFFALO.

SECRETARY LANGLEY in his annual report, just issued, makes the following appeal for the preservation of the Buffalo in the National Park:

When the Yellowstone Park was organized it was believed that a permanent place of refuge for the buffalo had been secured, and that out of the natural increase of the hundreds then remaining representative herds would be preserved for future generations. It seems now evident that the condition in the Yellowstone region are such that the extermination of the Government herd of buffalo may be anticipated, and that it may be accomplished within a very short space of time. The superintendent of the Park appears not to have adequate means for their protection, and there are on the border plenty of persons whose respect for law is insufficient to keep them from poaching when the prize is a buffalo head or skin which will readily sell for several hundreds of dollars. The temptation to these men seems to be irresistible, and as the herd diminishes, the value of the animals increases and the difficulty of protection becomes constantly greater.

Since, then, the extermination of the Yellowstone herd seems rapidly approaching, something should at once be done, that this may not mean the extinction of the Government control of the species, with the death of the few specimens now in captivity. Only one course suggests itself as completely efficient—transference of the great part of the now few remaining animals to a region where they can be effectively protected and increase normally under natural conditions, in which case the bison need not vanish from the face of the earth. Two years ago there were supposed to be 200 in the Yellowstone Park. The present estimate is one-quarter of that number. The superintendent reports them as being 'constantly pursued,' and in another year there may be none left. If these animals, or a majority of them, can dur-